Semiconductors

UM10014_4

ISP1520 Hi-Speed USB Hub Demo Board

Rev. 04.00 — 11 May 2004 User manual

Document information

Info	Content
Keywords	ISP1520, hub controller, USB, universal serial bus
Abstract	This document describes the ISP1520 hub demo board. It also contains the related schematics, the PCB layout, and the Bill of Material.

PHILIPS

Revision history

Rev	Date	Description
4.0	May 11, 2004	Updated the schematic.
3.0	April 14, 2004	Updated the following: • Section 2 • Section 4 • Section 5.5 • Section 6
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1.0	Nov. 2002	First release.

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1. Introduction

The ISP1520 is a Hi-Speed Universal Serial Bus (USB) hub IC, with four downstream facing ports. The ISP1520 Hub demo board is designed to demonstrate the features and functionality of the ISP1520. This version is targeted at low-cost designs. Nevertheless, it still contains a large number of features and options to be evaluated.

This document describes the ISP1520 hub demo board. It also contains the related schematics, the PCB layout, and the Bill of Material (BoM).

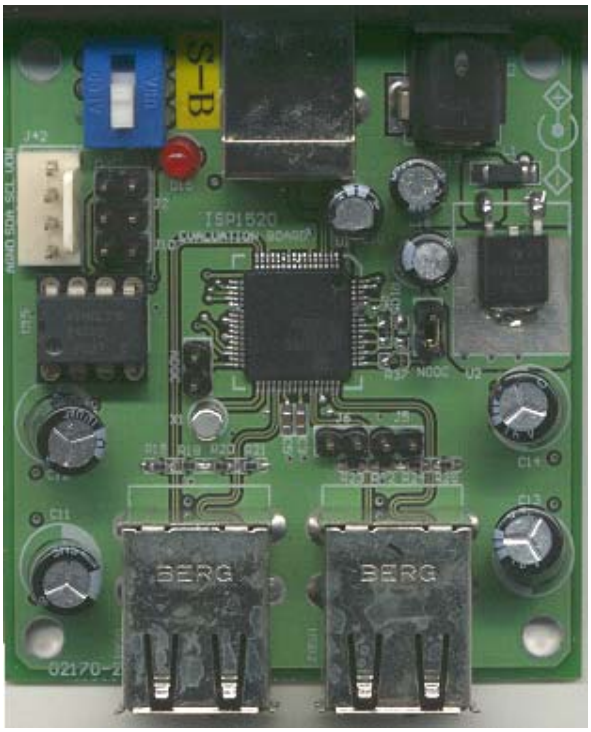

Figure 1-1: ISP1520 Hub demo board

2. ISP1520 Hub demo board Features

- Complies with ***Universal Serial Bus Specification Rev. 2.0***
- Supports self-powered operation
- Configurable number of downstream facing ports (from two to four)
- Customizable Vendor ID, Product ID and Serial Number (by using an external EEPROM or an external microcontroller)
- Individual power switching and individual overcurrent protection
- USB traffic indication (GoodLink™ LED) on the upstream facing port

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3. System Requirements

This hub can be attached to a computer that has a USB or Hi-Speed USB host installed, and running any of these operating systems:

- Windows® 98
- Windows Me
- Windows 2000
- Windows XP
- MacOS®

If this hub is plugged into a USB host controller, it will only work as a full-speed hub.

4. Power Supply Adapter Requirements

Regulated Output: 5.1V_{CC} ± 5%, 2.5A.

Warning: If you are using the board version *02170-2*, make sure that the power plug polarity is (+) at the core and (-) at the outer shield.

5. Hub demo board Description

5.1. ISP1520 64-Pin TQFP Package

The ISP1520 has the following port configurations:

- One Hi-Speed USB and Original USB capable upstream facing port (USB0), and
- Four Hi-Speed USB and Original USB capable downstream facing ports (USB1, USB2, USB3, USB4).

The downstream facing ports USB3 and USB4 can be disabled. By design, ports USB1 and USB2 cannot be disabled.

Table 5-1 shows the jumper setting versus port activation.

Table 5-1: Jumper Setting vs. Port Activation

J6, J5	Active Ports
OFF, OFF	1, 2, 3, 4*
ON, ON	1, 2

*—Default settings.

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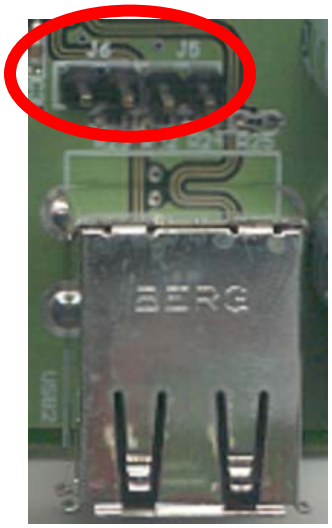
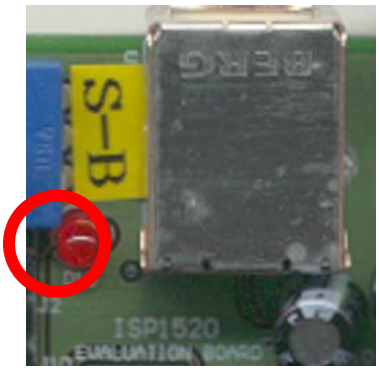


5.2. GoodLink Indicator

A Philips GoodLink LED D15 (red) is located near the upstream facing port. This LED blinks on every successful USB transaction.



5.3. Port Power Switch Transistors

The hub switches the bus power of each downstream facing port through a low ohmic PMOS transistor.

5.4. Overcurrent Circuit Detection

The integrated analog overcurrent detection circuit of the ISP1520 senses the voltage drop across the power switch. When the port draws too much current, the voltage drop across the power switch exceeds the trip voltage threshold. The overcurrent circuit detects this and automatically switches off the power switch. More information on choosing the switch and trimming the overcurrent detection voltage can be found in the ***ISP1520 Hi-Speed Universal Serial Bus hub controller*** data sheet.

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The hub demo board also contains an option to disable the overcurrent detection. This can be done in two stages. First place the NOOC jumper in the appropriate position to set the hub's descriptor (see Table 5-2).

Table 5-2: Overcurrent Detection Selection Using NOOC

NOOC	Overcurrent Detection	Logic State
ON	YES	0 (LOW)
OFF	NO	1 (HIGH)

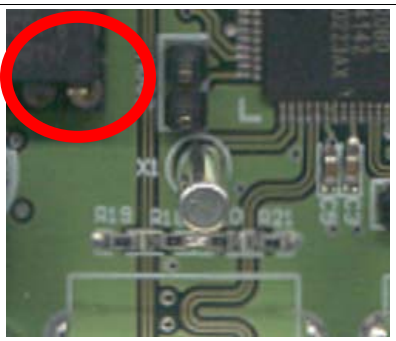
Then, desolder R28, R29, R30 and R31, and solder R32, R33, R34 and R36 on the PCB (see schematics).

As a lower cost alternative, there are provisions on the board to use polyswitches to handle overcurrent conditions. In this case the port switching transistors are bypassed. If this solution is preferred, then the overcurrent detection circuit inside the chip must be switched to the digital mode

Table 5-3: Mode Selection Using ADOC

ADOC	Mode	Logic State
ON	Digital	0 (LOW)
OFF	Analog*	1 (HIGH)

*— Default settings.



5.5. Power Supply

This hub demo board can be used as a self-powered USB hub. When used as a self-powered hub, use the provided power supply.

The SW1 switch sets the powering mode in the hub's descriptors; see Table 5-4.

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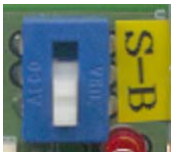

Table 5-4: Power Mode Selection Using SW1

SW1	Power Mode
S	Self-powered*
B	Ignore

*— Default settings.

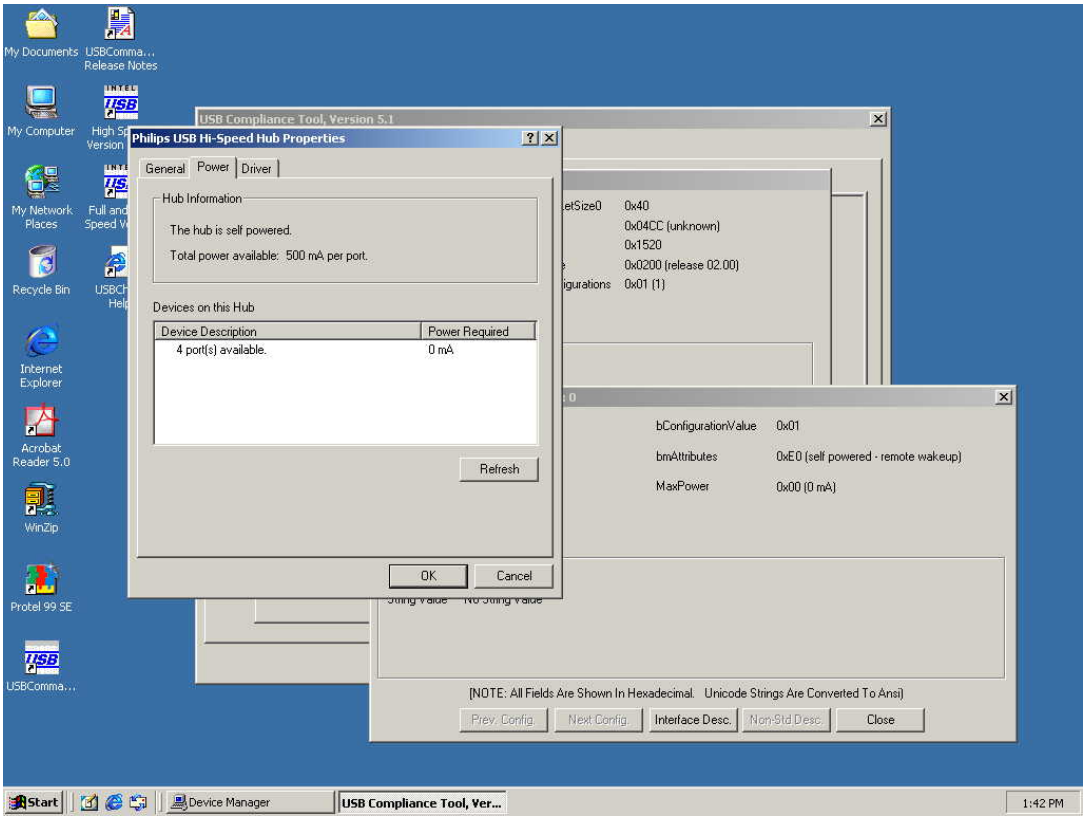

Figure 5-1: Windows Reporting of the Self-Powered Mode

5.6. I²C-Bus Interface

The ISP1520 can use either its USB descriptors from the internal ROM, or from an external I²C-bus™ EEPROM or microcontroller. Mode selection is done through jumpers J1and J2 (see Table 5-5:).

Table 5-5: Mode Selection Using J1 and I2

J1	J2	Mode	SCL	SDA
ON	ON	Internal ROM	LOW	LOW
OFF	OFF	I²C-bus EEPROM*	HIGH	HIGH

*—Default settings.

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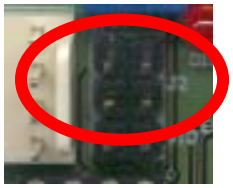

An external I²C-bus controller acting as a master can also be used to update hub descriptors through the J42 connector.

The J10 jumper is connected to the "Write Protect" pin of the I²C-bus EEPROM. The Hub Controller and the EEPROM have different I²C-bus device addresses. To program this IC on-board, select the jumper according to Table 5-6. It is recommended that you program the I²C-bus EEPROM before connecting the hub to USB through the USB host.

For convenience, the hub demo board is equipped with a socket for this component, allowing easy programming using a universal EPROM programmer as well.

Table 5-6: EEPROM Programming

J10	*WP_N*
ON	Write enable
OFF	Write protect

6. Schematics

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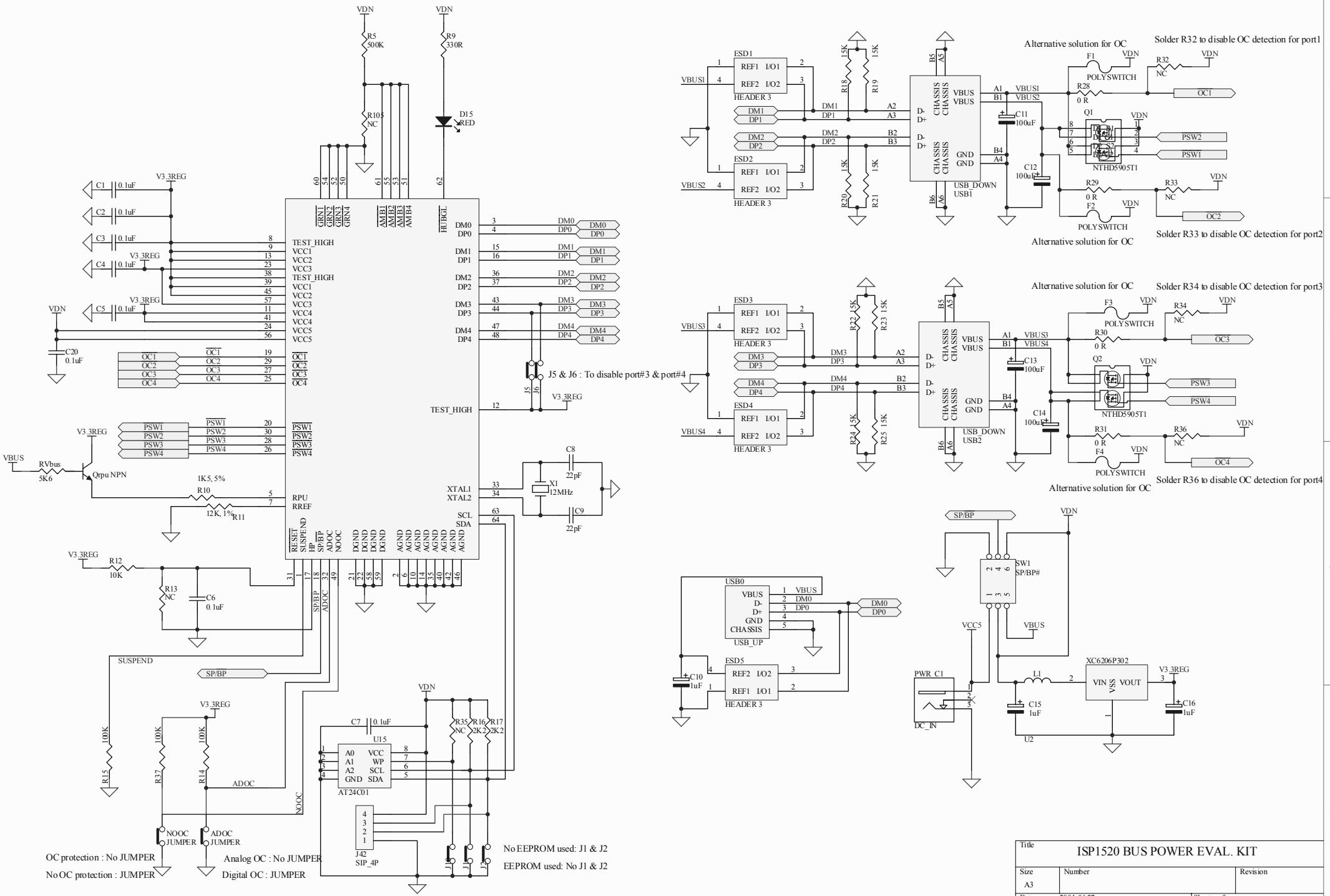
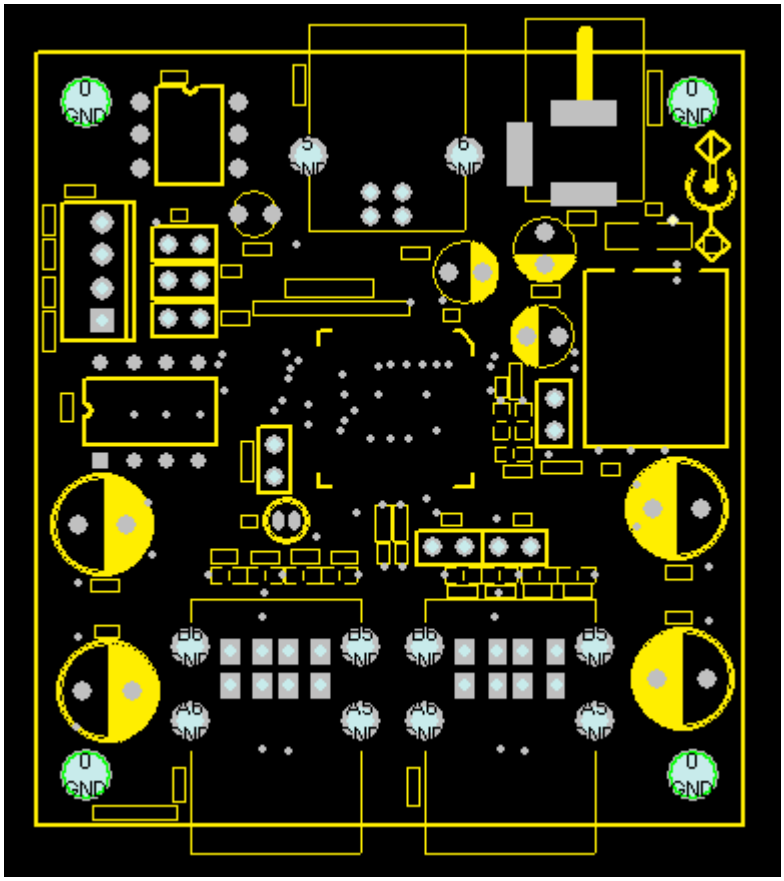


Title	ISP1520 BUS POWER EVAL. KIT	
Size A3	Number	Revision
Date: 2004-04-27	Sheet of	
File: C:\My NoteBook Raw\..\1520MINI_UPD.ADD Drawn By:		



Component Placement

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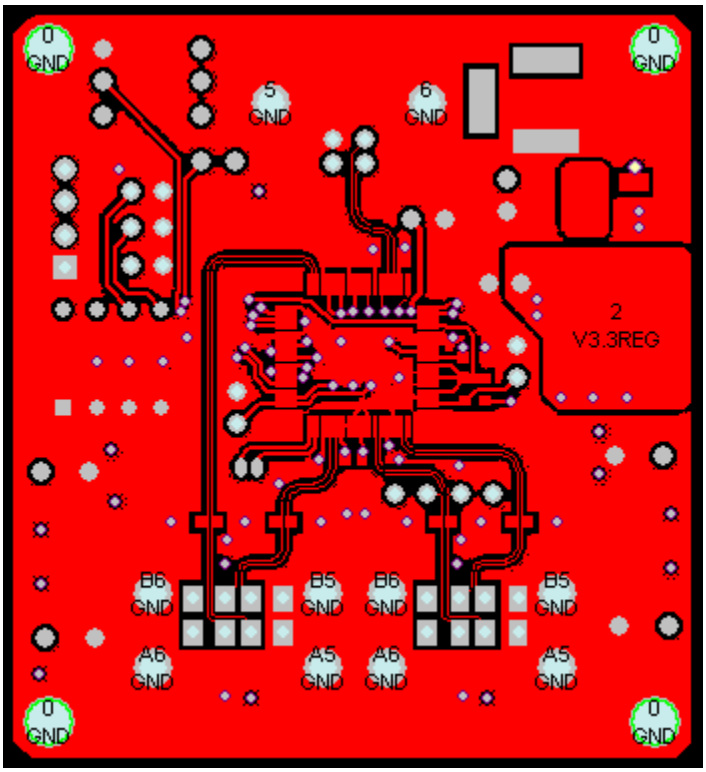

Layer 1: Top Routing

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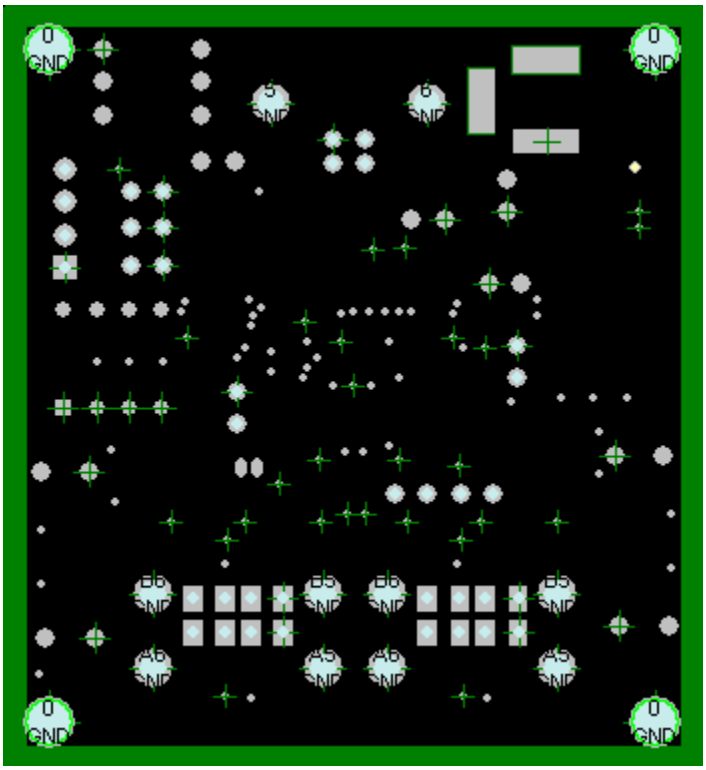

Layer 2: Ground Planes

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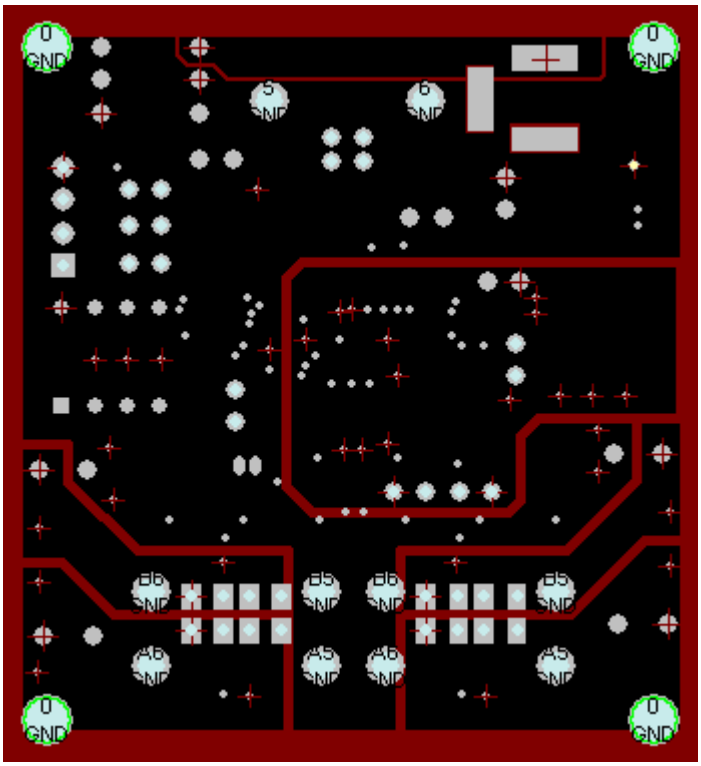

Layer3: Power Planes

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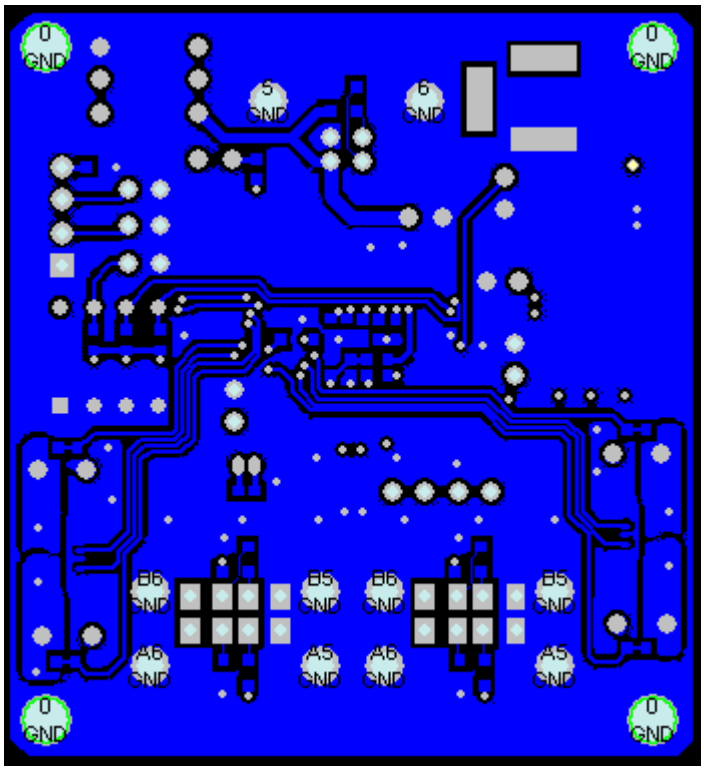

Layer 4: Bottom Routing

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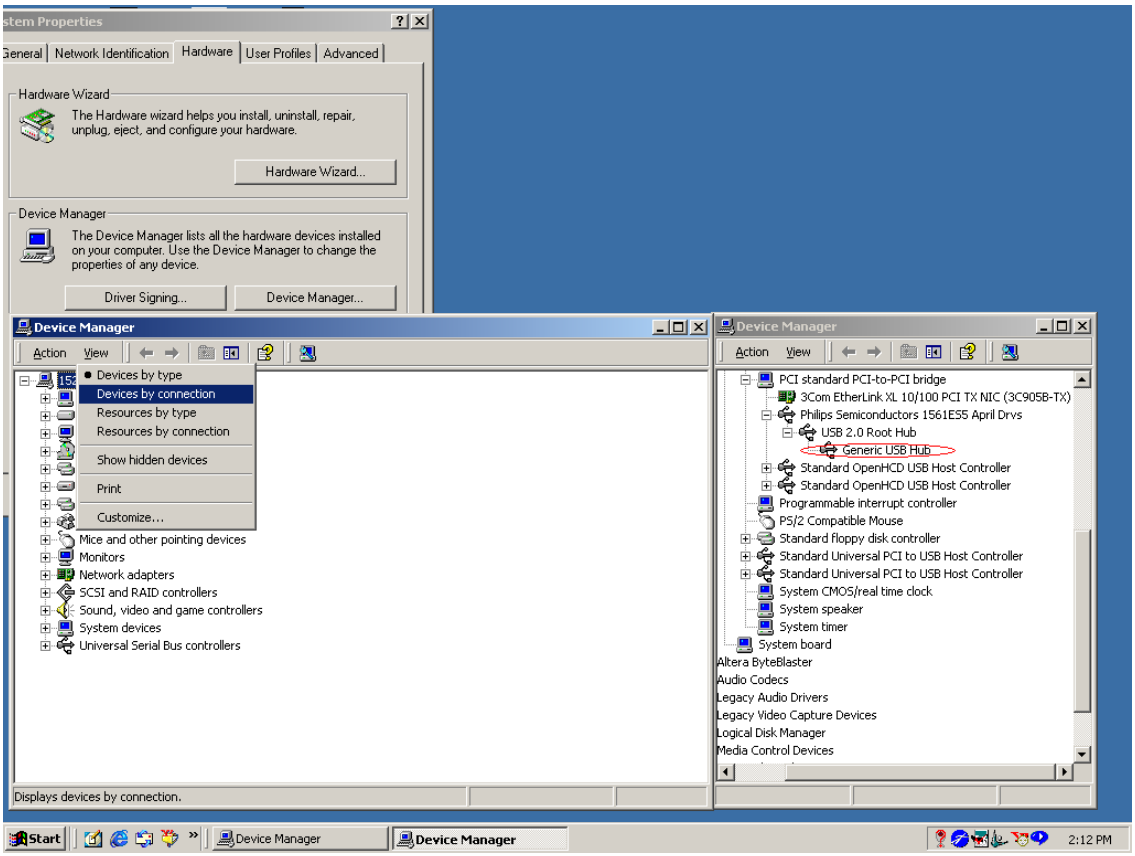
7. Installing the Board

Assuming that you have already installed the USB host adapter (including drivers) on a computer running Windows, installing the hub is fairly simple.

1. Plug in power from the power supply to the hub. The power supply must meet the requirements specified in Section 4.
2. Plug a USB cable in the USB0 port, and connect the other end of the cable to the USB host. After a while the GoodLink LED (D15) will start to blink. This indicates that the enumeration process has successfully completed and the hub is now ready for use.

You can check the driver installation in the Device Manager window. To check whether the hub is correctly installed in high-speed, select the ***View-Devices by connection*** command in the Device Manager window.



3. Plug in devices at the downstream facing ports.

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8. Bill of Materials for the ISP1520 Hub demo board

Part Type	Designator	Footprint	Description
0.1 F	C1 C2 C3 C4 C5 C6 C7 C20	0603C	Capacitor
0 Ω	R105 R32 R34 R31 R29 R30 R28 R33 R36	0603R	—
1.5 kΩ, 5%	R10	0603R	—
1 F	C10	REC1-2	Electrolytic capacitor
2.2 kΩ	R16 R17	0603R	—
10 kΩ	R12 R13	0603R	—
10 F	C15	REC1-2	Electrolytic capacitor
12 kΩ, 1%	R11	0603R	—
12 MHz	X1	XTAL7	Crystal
15 kΩ	R20 R19 R18 R25 R22 R24 R23 R21	0603R	—
22 pF	C9 C8	0603C	Capacitor
22 F	C16	REC1-2	Electrolytic capacitor
100 kΩ	R14 R15 R37 R5 R35	0603R	—
100 F	C11 C14 C12 C13	REC15-3	Electrolytic capacitor
330 Ω	R9	0603R	—
AT24C01	U15	DIP8	—
BLM41P600S	L1	1206CUST	—
DC_IN	PWR_C1	DC-JACK2	—
HEADER 3	ESD1 ESD2 ESD5 ESD4 ESD3	SOT-143	ESD protection *
ISP1520_LQFP64	U1	LQFP64	—
J1	J10 J1	RAD0.1	Jumper
J5	J5	RAD0.1	Jumper
J6	J6	RAD0.1	Jumper
J16	J2	RAD0.1	Jumper
JUMPER	NOOC ADOC	RAD0.1	Jumper
NCP1117	U2	TO-263/D2PAK	—
NTHD5905T1	Q1 Q2	CHIPFET	Logic level dual P-channel MOSFET
POLYSWITCH	F4 F2 F3 F1	POLYSWITCH	—
RED	D15	LED3	—
SIP_4P	J42	PS24254-4	Connector
SP/BP#	SW1	DIP6	—
USB_DOWN	USB2 USB1	USB-TYPEA-737745	—
USB_UP	USB0	USB-TYPEB	—

9. References

- ***Universal Serial Bus Specification Rev. 2.0 (http://www.usb.org/)***
- ***ISP1520 Hi-Speed Universal Serial Bus hub controller*** data sheet.

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